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OCEAN FREIGHT RATE INDEXES FOR HEAVY GRAINS 1961-69

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ABSTRACT

Indexes reflecting rates charged by voyage-chartered ships carrying heavy grain cargoes are presented. An index is shown for each major trade route in which the United States participates as well as a composite index covering all routes. All indexes demonstrated substantial annual fluctuations in 1961-69. Since 1965, the composite index has shown a declining trend.

Keywords: Grain cargoes, ocean shipping, exports, indexes.

CONTENTS

	<u>Page</u>
SUMMARY	iv
INTRODUCTION	1
METHODOLOGICAL CONSIDERATIONS	2
Selection of Rates	2
Origin and Destination Groupings	2
Size Groupings	4
INDEX COMPUTATION	4
General Form	4
Trade Route Indexes	4
Origin Indexes	6
Composite Index	6
OCEAN FREIGHT RATE VARIATIONS FOR HEAVY GRAINS	7
TRENDS	12

SUMMARY

Ocean freight rate indexes for heavy grains (corn, wheat, and soybeans) fluctuated considerably during 1961-69, resulting in an average yearly change of 11.1 points in the composite index.

The index for U.S. Gulf ports showed the greatest annual variation (13.5 points) with North Atlantic ports second (11.5 points). The Pacific Coast ports to West Coast India showed the greatest average change for routes (24.4 index points), followed by U.S. Gulf ports to Brazil (20.8 index points) and North Atlantic ports to Antwerp-Rotterdam-Amsterdam (19.6 index points).

From 1965 to 1969, Pacific Coast ports exhibited much higher rate levels than the other origin areas. In this period, however, the composite index trended downward, reflecting a general decrease in ocean freight rates for heavy grains. A drop in U.S. exports of heavy grains may have accounted for part of this decline. Another significant factor was the greater capacity of bulk carriers and tankers, which increased 49 and 25 percent, respectively.

OCEAN FREIGHT RATE INDEXES FOR HEAVY GRAINS, 1961-69

By: T. Q. Hutchinson, Industry Economist, and
Ruth Morrison, Economic Assistant
Economic Research Service
Marketing Economics Division

INTRODUCTION

Index numbers are comparative measures, expressing the ratio of the magnitude of a quantity at one time to its magnitude at another. Relative changes in magnitude over time can be more easily discerned in this way than when absolute quantities are presented. The ocean freight rate indexes developed in this study are part of a continuing series of the U.S. Department of Agriculture (USDA), and are supplemental to transportation indexes published to date.

A previous USDA study indicated that commercial grain exports moved only in vessels of foreign registry and that U.S. vessels were limited to shipping grain sponsored under Government programs. ^{1/} Rates charged by U.S. vessels, therefore, hold only limited interest for the private sector of the economy.

This study is limited to foreign registry ships transporting heavy grains (corn, wheat, and soybeans) under voyage charters. Known to the trade as tramp steamers or tramps, these vessels have no fixed ports-of-call and chiefly transport bulk commodities such as grain, coal, and fertilizers. Their rates are determined in a free market atmosphere by negotiations between the shipper and the carrier, with a shipbroker usually serving as an intermediary.

Although ships of various sizes and descriptions are voyage-chartered to carry grain cargoes, two types predominate in the grain trade--bulk carriers and tankers. Bulk carriers may be further subdivided into small and large vessels. The small vessels are often Liberty- or Victory-ship types of about 10,000 deadweight tons. ^{2/} These vessels were built as general cargo ships, but they are suitable for carrying grain. Large bulk carriers, many of which have self-trimming gear, are ships designed to carry dry bulk cargoes. They are substantially larger than general cargo ships, usually exceeding 15,000 deadweight tons.

Tankers are specialized bulk carriers, ranging in size from 16,000 to over 100,000 deadweight tons. Although designed for liquids, they are suitable for any free-flowing cargo. Some tankers have been constructed or converted to facilitate the unloading of grain.

^{1/}Hutchinson, T. Q., Heavy Grain Exports in Voyage-Chartered Ships: Rates and Volume, MRR No. 812, U.S. Dept. Agr., Econ. Res. Serv., Jan. 1968, p. 23.

^{2/}Deadweight tons--the carrying capacity of a ship in long tons (2,240).

METHODOLOGICAL CONSIDERATIONS

The base period selected for the computation of an index series is likely to have a significant impact on the level of the series. To make the indexes in this report comparable with other indexes published by USDA, 1967 was used as the base year. The choice of a reference base does not include the presumption that the year chosen was one of normality in all or even in major respects. The ocean freight rate indexes cover the years 1961-69.

Selection of Rates

Rate quotations were obtained from a variety of sources and represent quotations reported in New York and London--centers of ship chartering. ^{3/} Only rates for foreign-registry vessels carrying cargoes of at least 5,000 long tons were included.

Because of the large number of terms of charter available and their differences, statistically controlling differences in rates would involve a very large computational effort--greater than the resources available for the project. No attempt, therefore, was made to control differences in rates stemming from differences in terms of charter.

In addition to principal rates, many quotations provided for optional origins, destinations, or both. Since there was no way of determining which specific voyage was actually made, optional rates were aggregated with principal rates in computing averages used in the indexes. To avoid double counting, only principal quotations were used to determine the volume carried by voyage-chartered vessels.

Origin and Destination Groupings

Because data on charters were not available on a port-to-port basis, both origin and destination ports were combined into groupings commonly used by the shipping industry (table 1). For example, ports on the U.S. Gulf, including New Orleans and Baton Rouge, La., were considered as a single port for purposes of computing these indexes. Similarly, the Belgian port of Antwerp and the Netherlands ports of Rotterdam and Amsterdam were grouped together as Antwerp-Rotterdam-Amsterdam. Fifteen such trade groupings were used, representing major U.S. grain trades.

No groupings were used for Atlantic Coast ports south of Cape Hatteras. Charleston, S.C., the only port in this range to report any grain shipments during the base period, shipped only slightly more than one-half million long tons between 1967 and 1969.

^{3/}Maritime Research Inc., 11 Broadway, New York, N.Y., and the Journal of Commerce, 99 Wall St., New York, N.Y., publish these data; both sources were used in the study.

Table 1.--Origin and destination ports for heavy grain shipments in voyage-chartered ships, 1961-69

Origin port	:	Destination port
Great Lakes <u>1</u> /	:	Antwerp-Rotterdam-Amsterdam United Kingdom
St. Lawrence <u>2</u> /	:	Antwerp-Rotterdam-Amsterdam United Kingdom
North Atlantic <u>3</u> /	:	Antwerp-Rotterdam-Amsterdam United Kingdom
U.S. Gulf	:	Antwerp-Rotterdam-Amsterdam United Kingdom East Coast of India West Coast of India Japan Brazil
North Pacific <u>4</u> /	:	East Coast of India West Coast of India Japan

1/Includes Canadian and American ports on the Great Lakes and Churchill, Canada, on Hudson Bay.

2/Includes ports on St. Lawrence River and Gulf of St. Lawrence; St. John, New Brunswick; and Halifax, Nova Scotia.

3/Includes U.S. ports north from Cape Hatteras.

4/Includes U.S. ports north from San Francisco, and British Columbia ports.

Size Groupings

Substantial economies of scale are available in ocean shipping. ^{4/} In the negotiated market for voyage-chartered vessels, these returns to scale are assumed to be reflected in the rates established, especially when ship supply is large relative to demand. For this and other reasons when the size of ship may affect pricing, price variations over time were controlled statistically by size of ship. Shipments within each trade were divided into the following size categories: 5,000-9,999 long tons; 10,000-19,999 long tons; and 20,000-45,000 long tons. Since voyage-chartered ships do not normally carry partial loads of heavy grains, load size is approximately equal to vessel size.

INDEX COMPUTATION

General Form

The indexes in this report were computed by the weighted aggregate value method, according to the general formula:

$$I_r = \sum \frac{P_r W_0}{P_0 W_0} \times 100$$

where

I_r = index number for year r where r varies from 0 to S

P_r = annual average ocean freight rate for year r where r varies from 0 to S

W_0 = weights for base period

P_0 = annual average ocean freight rate for base period.

Three sets of indexes were computed: An index for each trade route; an index for each origin grouping; and a composite index. Each set represents a successively higher level of aggregation from the preceding one.

Trade Route Indexes

The annual average rates, P_j , used in constructing each trade route index are weighted averages computed as follows: The annual average rate in each ship size category is taken as the simple average of rates in that size category, or:

^{4/}Ferguson, A. R., and others, The Economic Value of the United States Merchant Marine, Northwestern University, Evanston, Ill., 1961, p. 175.

$$P_j = \frac{\sum p}{n}$$

where

P_j = annual average rate in the j th size category

p = individual rate quotations in the j th size category

n = number of rate quotations in the j th size category.

The annual average rates computed for each size category were combined into a weighted average. The weighting factor for each ship size category was computed by summing the volumes reported in the given ship size category in 1967, and dividing this sum by the total volume reported for that trade route during 1967. In algebraic notation:

$$V_j = \sum v$$

$$W_{0j} = \frac{V_j}{V_t}$$

where

V_j = sum of the individual volumes reported in a size category in a given trade route in the base year

v = individual volumes reported in a size category in a given trade route in the base year

W_{0j} = weighting factor for the j th size category

V_t = total volume reported in the given trade route by all size categories in the base year.

The index for each trade route I_t was thus computed by:

$$I_t = \sum \frac{P_{rj} W_{0j}}{P_{0j} W_{0j}} \times 100$$

where P_{rj} and P_{0j} are as defined above for P_r and P_0 , respectively, but limited to the j th size category.

Origin Indexes

The average price, P_t , used in computing origin indexes is the sum of the weighted prices for the particular trade routes served by each origin. These prices were then combined into a weighted average in which the weights are the relative volumes in each trade route. This weighting factor, W_{Ot} , was computed by dividing the total volume reported in the base year in a given trade route from a given origin by the total volume reported from that origin in the base year. Notationally,

$$W_{Ot} = \frac{V_{tw}}{\sum V_{tw}}$$

where

W_{Ot} = weighting factor for the origin

V_{tw} = volume reported in the j th trade from the origin by all size categories in the base year

$\sum V_{tw}$ = total volume reported in all trades from the origin by all size categories in the base year.

Thus, the index, I_w , for an origin was determined by:

$$I_w = \sum \frac{P_{rt} W_{Ot}}{P_{Ot} W_{Ot}} \times 100$$

where P_{rt} and P_{Ot} are as defined above for P_r and P_O , respectively, but are limited to rates for the origin in question.

Composite Index

The average annual rate, P_r , used in computing the composite index is the sum of weighted annual prices for all 15 trade routes. In notational form:

$$P_r = \sum (P_{rt} W_{Ot})$$

where

P_r = composite annual rate for a given year

P_{rt} = annual rate for a given origin in the given year as defined above

W_{Ot} = weighting factor as defined above.

This rate was then weighted by the volume found in each origin grouping. The weighting factor, W_0 , was found by dividing the total volume reported for a given origin grouping by the total volume reported (table 2). Notationally,

$$W_{0w} = \frac{V_w}{\sum V_w} .$$

Thus, the index, I_r , was determined by:

$$I_r = \frac{\sum P_r W_0}{P_0 W_0} \times 100 .$$

OCEAN FREIGHT RATE VARIATIONS FOR HEAVY GRAINS

As shown by the indexes for 1961-69 (table 3), ocean freight rates for heavy grains exhibited substantial fluctuations in this period. Indexes for St. Lawrence, Great Lakes, and North Atlantic origins moved together rather closely (fig. 1). The average yearly change in the composite index amounted to 11.1 index points. As shown in the figure, the index for the U.S. Gulf ports showed the greatest annual fluctuation (13.5 index points), followed by North Atlantic ports (11.5 index points).

In contrast to indexes for St. Lawrence, Great Lakes, and North Atlantic origins, indexes for U.S. Gulf ports and Pacific Coast ports north from San Francisco remained relatively far apart after 1963. Pacific Coast ports to West Coast India showed the greatest average change (24.4 index points), followed by U.S. Gulf ports to Brazil (20.8 index points) (table 3).

As noted earlier, 1967 was used as the base year for this study. During 1967, however, ocean rates tended to be considerably above the average of all rates for the decade. As a result, most of the index values shown in figure 1, using 1967 as the base year, are below 100.

Using a 1961-63 base, another index series was computed in the same manner (fig. 1). It shows a majority of index values above 100. Therefore, the decade of the 1960's may be more correctly characterized as a period of high rates for ocean grain transportation than one of low rates--as the 1967-based indexes would imply.

Table 2.--Percentage distribution of total volume of heavy grain shipped by trade and vessel size, 1967

Trade couplets	Vessel size in long tons				
	5,000- 9,999	10,000- 19,999	20,000- 45,000	Over 45,000	Total
	<hr style="border-top: 1px dashed black;"/> <u>Percent</u> <hr style="border-top: 1px dashed black;"/>				
Great Lakes:					
United Kingdom	1.32	1.65	0.11	--	3.08
Antwerp-Rotterdam-Amster- dam .....	.44	3.96	1.87	--	6.27
St. Lawrence:					
United Kingdom .....	.11	5.72	.88	--	6.71
Antwerp-Rotterdam-Amster- dam	--	1.32	2.09	--	3.41
U.S. Atlantic ports north from Cape Hatteras:					
United Kingdom .....	.55	5.28	.11	--	5.94
Antwerp-Rotterdam-Amster- dam .....	.11	1.21	.88	--	2.20
U.S. Gulf:					
United Kingdom .....	.22	1.32	--	--	1.54
Antwerp-Rotterdam-Amster- dam .....	.33	4.07	16.17	.55	21.12
East Coast of India .....	.11	.66	.77	.11	1.65
West Coast of India .....	.33	9.57	1.10	--	11.00
Japan	--	3.41	11.11	--	14.52
Brazil .....	.33	2.21	.99	--	3.53
Pacific Coast ports north from San Francisco:					
East Coast of India	--	2.64	.33	.11	3.08
West Coast of India	--	.44	.44	--	.88
Japan	--	13.42	1.65	--	15.07
Total	3.85	56.88	38.50	.77	100.00

Table 3.--Index numbers of ocean freight rates, all trades, 1961-69
(1967 = 100)

Origin and destination	1961	1962	1963	1964	1965	1966	1967	1968	1969	Average annual change
Great Lakes ports to:										
United Kingdom	91	78	86	86	95	98	100	79	79	7.0
Antwerp-Rotterdam-										
Amsterdam	92	82	101	96	102	93	100	73	89	12.4
Great Lakes index	92	80	95	92	99	94	100	75	85	10.4
St. Lawrence ports to:										
United Kingdom	94	75	89	91	102	100	100	83	81	8.4
Antwerp-Rotterdam-										
Amsterdam	111	73	101	95	107	88	100	79	94	18.9
St. Lawrence index	98	75	92	92	103	97	100	82	84	10.0
U.S. Atlantic ports north from Cape Hatteras to:										
United Kingdom	105	84	101	105	112	101	100	90	103	10.5
Antwerp-Rotterdam-										
Amsterdam	116	69	97	102	105	86	100	73	59	19.6
U.S. Atlantic index	107	80	100	104	110	98	100	86	93	11.5
U.S. Gulf ports to:										
United Kingdom	122	85	118	112	135	105	100	89	88	18.3
Antwerp-Rotterdam-										
Amsterdam	94	80	111	101	109	86	100	85	86	14.5
East Coast of India	66	52	70	74	87	87	100	95	80	10.2
West Coast of India	63	51	69	75	83	80	100	85	59	13.5
Japan	99	72	96	98	111	93	100	80	75	14.5
Brazil	73	68	124	101	115	82	100	88	93	20.8
U.S. Gulf index	83	66	91	90	100	86	100	84	73	13.5

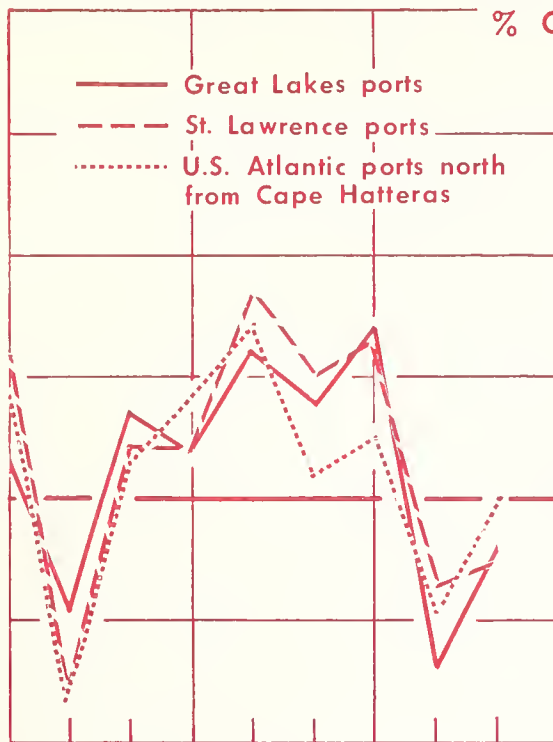
--Continued

Table 3.--Index numbers of ocean freight rates, all trades, 1961-69 --Continued
(1967 = 100)

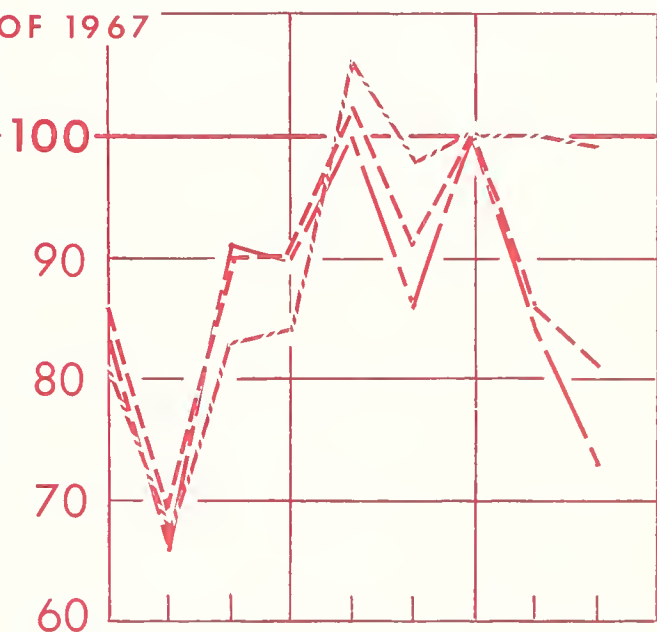
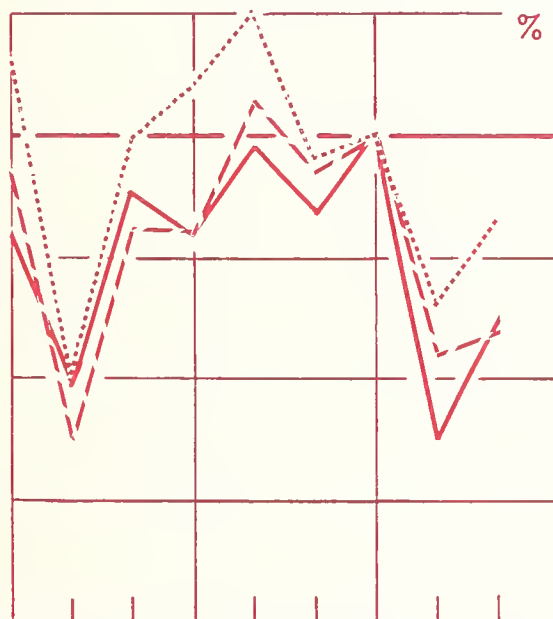
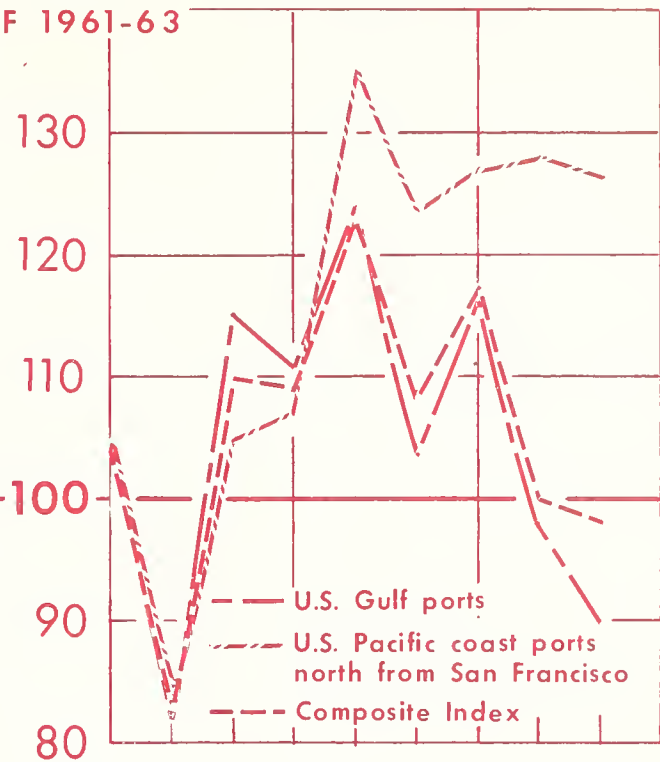
Origin and destination	1961	1962	1963	1964	1965	1966	1967	1968	1969	Average annual change
Pacific Coast ports north from San Francisco to:										
East Coast of India	79	69	87	84	109	115	100	94	99	11.0
West Coast of India	114	88	117	113	162	136	100	121	125	24.4
Japan	80	65	79	82	101	91	100	101	96	9.5
Pacific Coast index	81	67	83	84	106	98	100	100	99	8.0
Composite index	86	69	90	90	102	91	100	86	81	11.1

HEAVY GRAIN OCEAN FREIGHT RATE INDEXES*

ST. LAWRENCE, GREAT LAKES,
AND NORTH ATLANTIC PORTS



PACIFIC COAST AND
U.S. GULF PORTS



1961 1964 1967 1970 1961 1964 1967 1970

* FOREIGN FLAG VESSELS.

Figure 1

TRENDS

The composite index has trended downward since 1965, reflecting a general decline in ocean freight rates for heavy grains. This decline may partly be attributed to a decrease in U.S. exports of heavy grains in 1968 and 1969 (table 4).

A more significant long-run factor is the size and capacity of the world's merchant fleet which has expanded by about 1,000 vessels of all types since 1965 (table 5). Even before the Suez Canal was closed, many of these vessels were going around the Cape of Good Hope because they were too large for the Canal.

More significant still is the increase in average capacity of vessels from 1965 to 1969. As shown in table 6, the average capacity of bulk carriers and tankers increased in this period by 49 and 25 percent, respectively. Although the new large tankers (100,000 deadweight tons and over) do not carry grain, they have tended to displace smaller vessels from other cargo trades. Consequently, these displaced vessels may have entered the grain trade.

In 1967, the rate index hit a short-run peak for all U.S.-originating trades, except the West Coast. The closing of the Suez Canal in later spring 1967 brought about an immediate increase in grain rates for most trade routes. Ships traveling between the United States and East Asia probably were rather suddenly in short supply due to the Suez Crisis. During the fourth quarter of 1967, freight charges trended down from the third quarter peak.

Table 4.--U.S. exports of corn, wheat, soybeans, and grain sorghums, 1965-69 1/

Year	Corn	Wheat	Soybeans	Grain sorghum	Total
	<u>1,000 bu.</u>				
1965	596,750	650,374	227,660	172,346	1,647,130
1966	612,120	826,115	248,071	291,146	1,977,452
1967	509,247	642,070	263,418	228,181	1,642,916
1968	588,878	592,233	294,478	139,628	1,615,217
1969 <u>2/</u>	549,284	444,088	311,145	106,519	1,411,036

1/U.S. Foreign Agricultural Trade by Commodities, Calendar Year 1969, U.S. Dept. Agr., Econ. Res. Serv.

2/Preliminary.

Table 5.--Number of selected types of merchant vessels at year end, 1965-69 1/

Year	Freighters	Bulk carriers	Tankers	All types
	<u>Number</u>			
1965	11,019	1,971	3,582	18,329
1966	10,931	2,103	3,654	18,423
1967	10,963	2,368	3,740	18,800
1968	11,052	2,609	3,895	19,361
1969 <u>2/</u>	10,974	2,676	3,967	19,415

1/Merchant Fleets of the World, Seagoing Steam and Motor Ships of 1,000 Gross Tons and Over, as of December 31, U.S. Dept. Comm.

2/Preliminary.

Table 6.--Average deadweight tonnage of world merchant fleets, by vessel type,
1965-69 1/

Year	Freighters	Bulk carriers	Tankers
	<u>1,000 tons</u>		
1965	7.9	16.0	25.0
1966	7.9	16.0	26.9
1967	7.8	21.0	28.2
1968	7.8	23.0	30.1
1969 <u>2/</u>	7.8	23.8	31.3
	<u>Percent</u>		
Percentage change 1965-69 .....	.0	48.8	25.2

1/Merchant Fleets of the World, Seagoing Steam and Motor Ships of 1,000 Gross Tons and Over, as of December 31, U.S. Dept. Comm.

2/Merchant Fleets of the World, Seagoing Steam and Motor Ships of 1,000 Gross Tons and Over, as of June 31, 1969, U.S. Dept. Comm.



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